

SCCWRP Annual Report 2012

General regression neural networks to estimate hydromodification response in semi-arid southern California streams

Ashmita Sengupta, Eric D. Stein and Robert J. Hawley^{1,2}

¹*Sustainable Streams LLC, Louisville, KY*

²*Colorado State University, Department of Civil and Environmental Engineering, Fort Collins, CO*

ABSTRACT

Changes in basin hydrology often result in geomorphic impacts to receiving channels, typically manifested as channel widening, deepening or both. Estimating these effects using traditional deterministic models is challenging due to the high number of factors that influence channel response and the highly stochastic nature of the responses. In this study we present General Regression Neural Network (GRNN) models as an additional tool to predict the effects of hydromodification in semi-arid streams of southern California. We developed GRNN models to predict the change in the stream channel cross section area using flows for 2, 10, 50, and 100-year return intervals as the primary independent variable, and compared the output to results of linear Multivariate Regression models (MVR) for the same region. Models were compared in terms of their predictive ability, sensitivity, and capacity to accommodate missing input data. Results show that the GRNN approach consistently outperforms the MVR by large margins as indicated by higher correlation with field validation data. GRNN analysis showed that the primary drivers of channel response to hydromodification vary depending on which flood return interval is included as the primary independent variable. Furthermore, variable-ranking properties of GRNN allowed us to reduce the number of predictor variables from 100 to the 29 to 40 most responsible for channel response (depending on the return interval). Our results suggest that GRNN predictions can be used in concert with other tools to help inform management decisions, such as the need for flow-duration based stormwater controls, and to tailor monitoring programs.

Full Text

ftp://ftp.sccwrp.org/pub/download/DOCUMENTS/AnnualReports/2012AnnualReport/ar12_099_112.pdf